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AN

ACCOUNT

OF A

FILARIA IN A HORSE'S EYE,

WITH

REMARKS ON SIMILAR PHENOMENA,

AND THE

MODE OF THEIR ORIGIN,

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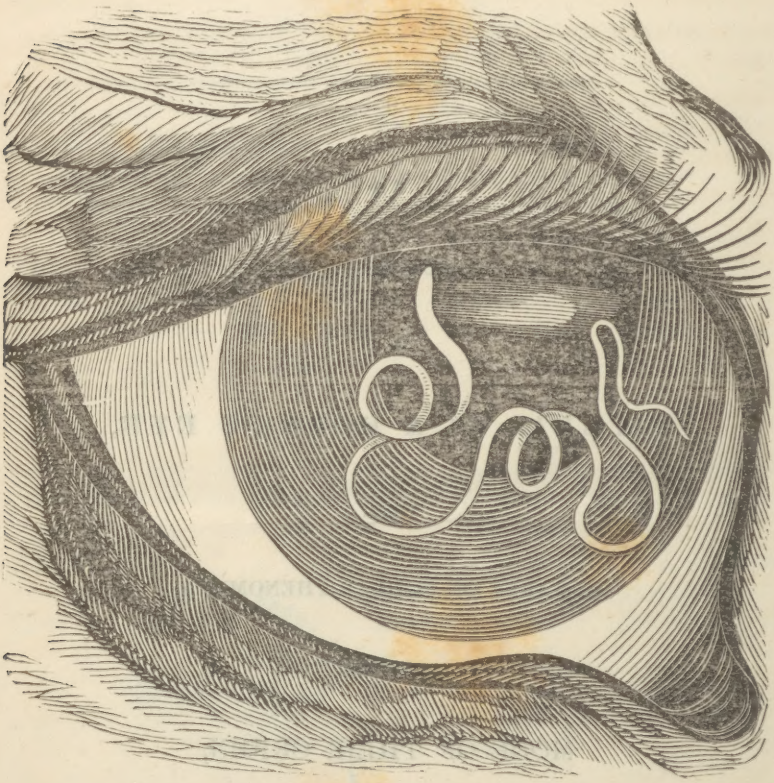
ACCOUNT, &c.

Read before the Lyceum of Natural History of New York.



The existence of parasitic worms in the interior of animals has been known from a very remote period. They are mentioned by Hippocrates, Galen, Celsus, Pliny and other writers; and various speculations have been advanced in respect to their origin. It is only however within modern times that they have received much attention from physicians and naturalists, except as to their agency in the production of disease. Many different genera and species have now been described by Linnæus, Rudolphi, Bremser, De Blainville, Cruvelhier and others, and arranged according to their several characters. Indeed so numerous have

these animals become, that their study constitutes quite an important branch of zoology. Large and important works have been written upon a single species of these parasites, and Dr. Nordmann of Germany has lately published a treatise on those that inhabit the eyes of the higher orders of animals. They may be arranged under two general divisions. 1. The *Entozoa*, or those which reside in the internal parts of the animal, and 2. *Ectozoa*, those which are confined to the external surface. The latter are chiefly *insects*, the former *worms*.

Linnæus arranged the *Entozoa* according to the situation which they occupied: viz. such as are developed in cavities communicating with the external air, as *intestinal worms;* and such as are imbedded in the very *substance* of organs, *visceral worms*. The classification of Rudolphi, however, is founded on the varieties of form, as *Nematoides*, *Acanthocephala*, *Trematoda*, *Cestoides*, *Tænia*, and *Cystica* or *hydatids*. Cuvier divides them into two classes; one characterized by a digestive cavity, and the other by the parenchymatous structure.

A horse is now being exhibited in this city whose right eye contains a vermiform animal, floating in the anterior chamber, between the *iris* and the *cornea*. It was first observed in February last, when it was about half an inch in length; since which time it has increased so as to measure at present about four inches, resembling a portion of white thread or bobbin, with an enlargement at one extremity of half an inch or more in extent. The animal is confined exclusively to the anterior chamber of the eye, in which it swims with the greatest ease and activity; doubling itself in every direction, and performing the most graceful and rapid evolutions. It seems remarkable that it should not penetrate the iris, and visit the posterior chamber. Why it does not, it is impossible for me to explain. Its movements do not appear to excite any sensation in the horse, although a milky cloudiness in the aqueous humor, somewhat dims the vision of the eye in which it floats. This discoloration is believed by Mr. Camp, the owner of the horse, to be owing to the *excreta* of the parasite, which, he says, are evacuated about once in three weeks, when the eye appears much more clouded than at other times. This, however, is observed to subside considerably in the course of a few hours. Whether this be a fact, may well admit of a doubt. We think it more probable that the cloudiness is owing to the ef-

fusion of coagulable lymph, the result of inflammation of the vessels, caused by the presence of a foreign body. There is no doubt whatever that the discoloration exists in the aqueous humor, and not in the cornea. A few weeks after the animal was first discovered, the conjunctiva was much injected; but since that time it has assumed its natural, healthy appearance, and now does not differ in the least from that of the other eye. There is nothing peculiar in the appearance of the horse, which is of the Eclipse family, and seven years old. Owing to the incessant and rapid motion of the worm, it is difficult to examine it with a microscope, so as to determine with accuracy, its precise internal organization, yet it evidently belongs to the class *Entozoa*, order *Nematoidea*, genus *Filaria*, species *Papillosa*. The only other genus which it resembles, is the *Gordius* of Linnæus; but as this belongs to the class *Annelides*, which have red blood, inhabit the water only, and are more filiform in shape, there is but little danger of confounding them together.

We have stated that the *Entozoa* are so called because they inhabit the interior of other animals. Every kind of animal, indeed, has been supposed to have its *Entozoa*, or internal parasites, which are peculiar to itself, just as it has its *Ectozoa*, or external ones. They not only infest the alimentary canal, and the ducts leading into it, but also the *muscles*, the *cellular tissue*, and the *parenchymatous structure* of the different organs, as the brain, liver, lungs, kidneys, &c. Indeed, it is now believed by many naturalists, that every different tissue and organ of the body has its peculiar parasite. Thus in man, more than twenty different species of animals have been discovered in different parts of his body. In the *brain*, we find the *Echinococus hominis;* in the *liver*, the *Fasciola hepatica;* in the *venous blood*, the *Linguatula venarum;* in the *kidneys*, the *Strongylus gigas;* in the *muscles*, the *Hydatigera cellulosa;* in the *cellular tissue*, the *Filaria medinensis*, or Guinea worm; in the *female ovaries*, the *Linguatula pinguicola;* in the *intestines*, the *Tænia solium*, the *Ascaris lumbricoides*, &c.; and some attack infants only, as the *Oxyurus vermicularis.*

Mr. Richard Owen, of England, has lately discovered that the human muscles of voluntary motion are sometimes the residence of very minute cysts of an oblong figure, in size and color bearing a strong resemblance to *nits*, or the young of *pediculi.*

These cysts appear, when examined with a lens, not exactly ovoid, but irregularly contracted towards one extremity, so as to form a kind of short neck. These are dispersed throughout the the muscles over the body, and are placed in the direction of the fibres, in the cellular membrane, immediately investing the muscular fibrillæ, or the tendinous fibres to which they are attached. In a recent specimen, one and sometimes two thread-like worms may be seen, coiled up in each cyst. Mr. Owen regards this animal as closely allied to the eels which are found in paste and vinegar, and has given it the name of *Trichina spiralis*. It is very probable that some anomalous diseases may be occasioned by the great multiplication of these worms, while the cause is unsuspected and inexplicable.

The most common worm met with in the different classes of animals, is the *fluke*, or *Fasciola hepatica*, which is sometimes also found in man. We find it in cattle, sheep, swine, and deer; in reptiles, fishes, and even worms of the largest kind; and it is this which occasions the disease called the *rot* in sheep. Leuwenhoeck counted 870 of these animals in one liver. Hydatids are also found in sheep, in the brain and liver, and often carry off whole flocks. This is also met with in man, swine, deer and oxen, of which there are three different species, viz. *cerebralis*, *vervecina*, and *ovilla*. It is unnecessary however to go into detail, in relation to the different species of parasites which inhabit the different races of animals; it must suffice to state, that they are extremely numerous,—that though some are common to several species, yet that, in general, each has its peculiar parasite;—and, moreover, that probably each texture and organ furnishes a habitation for a distinct race of inhabitants. To this it might be added, that many of these parasites have parasites of their own, so that they are literally paid in their own coin.

It has been remarked that the *Filaria* belongs to the order *Nematoidea* of Rudolphi. This order embraces those animals whose external skin is more or less furnished with muscular fibres, and usually striated transversely; containing an abdominal cavity, in which is a distinct intestinal canal, extending nearly the whole length of the body. The intestine is connected with the neighboring parts and the general envelope of the body by numerous threads, considered by some writers as vessels for the conveyance of the nutritious fluid, and by others as *tracheæ*, but without suf-

ficient proof of the fact. We can discover no true circulation in these animals, but in several there appear to be one or two nervous cords, which surround the mouth, and extend the whole length of the body along the internal surface of the envelope. The intestine is for the most part straight and of considerable width; the esophagus is contracted, and in some species the stomach is distinctly developed. The animal is of both sexes and propagates by *ova*, which are extremely small.

The *Filaria* is of a long, slender, filiform shape, and perforated at the anterior extremity by a round oval aperture. Some species bear considerable resemblance to the *Gordius*, or hair-snake, which abounds in fresh-water brooks and ponds. It principally occurs within cavities which do not communicate externally,—in the cellular membrane, the substance of the muscles, and different viscera, and occasionally in the eye. The following embrace a few of the more common species.

1. *Filaria medinensis*, or Guinea worm, is the most common and best known species. It is found chiefly in warm climates, where it is often seen in the morning dew, sometimes ten or twelve feet long, and not thicker than a horse-hair. It is this species which insinuates itself under the skin, where it may be felt like a tense string. Here it burrows and grows to a length of several feet, without exciting great pain or uneasiness, until the skin is perforated by the animal. It is usually drawn out with great caution, by means of a piece of silk tied around its head. If it break by a too violent effort, the part remaining grows with redoubled vigor, and often occasions a fatal inflammation. When drawn out, it is found to be elastic, white, transparent, and contains a gelatinous substance. Though usually met with in the lower extremities, it sometimes occurs in the integuments of the head, neck and trunk, and Baron states that he saw two instances of it under the mucous membrane of the eyeball.

2. *Filaria bronchialis.* This species is described by Treutler, and so named from its occurrence in the lungs of persons laboring under phthisis. It has also been called *Hamularia lymphatica*, and by Rudolphi, *Haularia sub-compressa.* This is also met with in the lungs of the inferior animals, especially when affected with tubercles. Dr. Hodgkin states that he often found the Filaria in the lungs of the *boa constrictor.*

3. *Filaria gracilis* is found in apes and monkeys in great abundance. It grows to a length of ten or twelve inches, is about as thick as a fine thread, head obtuse, and tapering slightly at both extremities.

4. *Filaria attenuata.* This species is found in the abdominal cavity of crows, also in the cornea of the eye of fishes. It is from one to six inches long, and obtuse at both extremities.

5. *Filaria obtusa* inhabits the intestines of swallows. Its head is somewhat acute, tail obtuse, body comparatively thick and elastic, and has been found twelve inches in length. M. Rudolphi has traced out its intestinal canal and ovaries.

6. *Filaria truncata.* This species is about five inches long, has a truncated head, a tail somewhat thick, obtuse, terminated by a very sharp point; inhabits the *larva*, or caterpillar of certain species of moths. (*Tinea padella.*)

7. *Filaria ovale.* This species formerly went under the name of *Gordius piscium*, (hair-worm of fishes,) because it is found in the liver of the *carp*. It is three or four inches in length; head oval; tapering forwards; tail round.

8. *Filaria capsularia.* From half an inch to an inch long, and resembles in thickness a middle-sized thread. The borders of the mouth are recurved, resembling, according to De Blainville, the mouth of a pudding-bag; tail obtuse, papilliform, and ending with a fine, sharp point. It occurs of both sexes, with a large intestinal canal and stomach. The female is more gross—often met with in the herring, in large quantities. It is very tenacious of life, for Rudolphi states that he has known it live eight days in a dry place, and even to revive after having been long frozen in masses of ice. It is this species which Zeder and some other naturalists have formed into a *genus*, under the name of *Capsularis.*

9. *Filaria papillosa.* The *Filaire equi* of Gmelin, and the *Gordius equinus* of other writers. This is the species which inhabits the eye of the horse. It is from one to seven inches in length, and about one-third of a line in diameter. It is usually of a yellowish white or ash color,—sometimes of a brownish hue. Head slightly obtuse; mouth orbicular; neck studded with papillæ; tail slender and curved. It occurs in different parts of the horse, chiefly in the muscles and intestinal canal, though it has been detected in the brain, as well as the aqueous humor of the eye.

M. De Blainville, in the *Dictionnaire des Sciences Naturelles*, describes twelve species of *Filaria*, and mentions thirty-one others, which are doubtful, and whose names are derived from the species of birds, fishes, quadrupeds, insects and reptiles which they inhabit. The points of difference among these do not appear sufficient to constitute them into distinct species, with the exception, perhaps, of the four following, viz. *coronata*, *acuminata*, *plicata* and *alata*, which have been minutely described by Rudolphi and De Blainville. For our knowledge of the others, we are chiefly indebted to Lamarck and Rœssel. The principal animals in which the *Filaria* has been detected are the *vulture*, *eagle*, *falcon*, *owl*, *swan*, *duck*, *stork*, *heron*, *lark*, *starling* and *linnet*, among birds, and the *horse*, *swine*, *ox*, *hare*, *weasel* and *lion*, among quadrupeds; in numerous species of fishes, and coleopterous insects, among the lower orders.

Dr. Nordmann, in his work above referred to, states that he has detected the *Filaria* in the eye of a person affected with cataract, also a hydatid in the eye of a young woman. Ehrenberg agrees with Nordmann in opinion that cataract and some other diseases of the eye, are probably owing to an accumulation of these parasitic animals. This writer has shown very satisfactorily that quadrupeds, birds, reptiles and fishes have each their *eye-worms*, which are, for the most part, peculiar to each species. Several of these are figured in his work; among which, one that infests the eyes of different species of perch, is very conspicuous. In one instance he counted 360 of these in the eye of a single fish affected with cataract. "This little animal," says Kirby in his Bridgewater Treatise, "appears something related to the *Planaria* or *pseudo-leech*, and from Dr. Nordmann's figures seems able, like it, to change its form. Underneath the body, at the anterior extremity, is the mouth, and in the middle are what he denominates two sucking-cups; these are prominent, and viewed laterally form a truncated cone; the anterior one is the smallest and least prominent, and more properly a sucker; the other probably has other functions, since he could never ascertain that it was used for prehension."

It is remarkable that these animals, small as they are, are infested with parasites of their own. These appear like minute brown dots or capsules, attached to the intestinal canal. When extracted and laid upon a smooth surface, these capsules burst,

and disclose a great number of living animalcules, of the genus *Monas.*

The accompanying magnified sketch will represent the form of this animal with sufficient exactness.

Achtheres percarum.

Of the worms which Nordmann describes as infesting the eyes of fishes, five out of seven are attached to different species of perch. Kirby conjectures that as these constitute the most numerous body of predaceous fishes in rivers, the object of this singular provision is to impair their organs of vision, so that the roach, dace, carp and tench tribes may not be entirely destroyed.*

Instances of the occurrence of *Filaria* in the human eye, have been recorded by different authors. In a late German medical periodical, (*Zeitschrift fur die gesammte Medicin*, Feb. 1839,) several cases of this kind have been recorded. Blot of Martinique saw two worms in active motion under the conjunctiva, which he removed by incision. One of these, which was sent to M. Blainville, was thread-shaped, thirty-eight millimetres long, with a black protuberance adapted for suction. Bajon, in 1768, observed a Filaria in the eye of a negress, which kept in a continual serpentine motion without producing pain; but it caused a constant epiphora, or watery secretion. When an incision was made the worm went to another part, and was obliged to be secured by a

* It is now a well ascertained fact that animals not only inhabit vegetables, but that vegetable growths are sometimes observed in the bodies of living animals. The most remarkable example of this, perhaps, is that of the "*vegetating wasp*" of our Southern States and the West Indies. The insect, which is a species of *Polystrix*, is infested, while alive, with a parasitic fungus allied to *Sphæria*, which gradually increases so much in size as to destroy the life of the animal, which having deposited its eggs in the plant, perishes; when, in due time, a second generation succeeds, which is cut off in the same manner, and so on. Similar instances have been observed among other insects, in all stages of their development.

small forceps. In a second case the conjunctiva was more inflamed, and the patient refused to submit to an operation. In Blot's case above-mentioned, the worms were between the conjunctiva and the cornea, around and across which they traversed, producing stinging pains and nervous symptoms. The patient, an African negress, was unable to tell where she came from, or whether her fellow-country people were subject to similar affections. The *Cystericus cellulosa* has also often been observed in the human eye, of which there is a case in the *London Medical Gazette* for Aug. 1833, where one was seen in the eye of a little girl six years old, under the *conjunctiva* resting on the *sclerotica*, and perfect in all its parts.

The existence of *Filaria* in the eyes of horses in the East Indies, is of frequent occurrence, as may be seen by consulting an article in the *Edinburgh Medical and Surgical Journal* for Jan. 1826. Bremser states that he saw three worms in the anterior chamber of the eye of a horse at the Veterinary School of Vienna, in 1813. In the *Bulletin des Sciences Medicales* for Feb. 1826, it is stated that Dequilleme saw several of these animals in the eye of a cow, and the case was published by Gohier, a veterinary teacher, in his memoirs. In the report of the proceedings of the Veterinary School at Lyons, in 1822, there is a case in which a *knot* of worms was seen in the eye of a mule. Some of these were extracted; no inflammation followed the operation, but a violent nervous agitation of the head and a turning of it to the left side, took place. In the same journal mention is made of a memoir read before the Medical Society of Calcutta, in which the writer states that the *Strongylus armatus minor* of Rudolphi, and the *Filaria papillosa* are frequently found in the eyes of horses in India, but much more so in the cellular membrane, particularly about the loins. The writer maintains that they make their way into the blood-vessels, and through them into the eye. Treutler says that he has seen the *Strongylus armatus* in aneurisms of the mesenteric artery of the horse, and Dr. Kennedy, in the Edinburgh Phil. Transactions, describes a worm which he calls *Ascaris pellucidus*, but which was doubtless the *Filaria papillosa*, as being common in the eyes of horses in the east. A common effect of these worms in the muscles of the loins is paralysis of

the hind legs.* The only case of the kind which has come to my knowledge, as having occurred in our own country, is recorded in the second vol. of the Transactions of the American Philosophical Society. This volume contains two communications on the subject,—one by F. Hopkinson, Esq., entitled "*Account of a worm in a horse's eye;*" the other by John Morgan, M. D., "*Of a living snake in a living horse's eye, and of other unusual productions of animals.*" Mr. Hopkinson reports the case as follows: "A report prevailed last summer that a horse was to be seen which had a living serpent in one of his eyes. At first I disregarded this report, but numbers of my acquaintance who had been to see the horse, confirming the account, I had the curiosity to go myself, taking a friend along with me. The horse was kept in Arch street, and belonged to a free negro. I examined the eye with all the attention in my power, being no ways disposed to credit the common report, but rather expecting to detect a fraud or vulgar prejudice; I was much surprised, however, to see a real living worm within the ball of the horse's eye. This worm was of a clear white color, in size and appearance much like a piece of fine bobbin; it seemed to be from two and a half to three inches in length, which, however, could not be duly ascertained, its whole length never appearing at one time, but only such portion as could be seen through the iris, which was greatly dilated. The creature was in constant lively vermicular motion; somtimes retiring so deep into the eye as to become totally invisible, and at other times approaching so near to the iris as to become plainly and distinctly seen; at least so much of it as was within the field of the iris. I could not distinguish its head, neither end being perfectly exhibited whilst I viewed it, and indeed its motion was so brisk and constant, that so nice a scrutiny was not to be expected. The horse's eye was exceedingly inflamed, swollen and running; I mean the muscles contiguous to the eye-ball, and seemed to give him great pain, so that it was with much difficulty the eye could be kept open for more than a few seconds at a time; and I was obliged to watch favorable moments for a dis-

* A singular case is reported by M. Cloquet, in the *Archives Generales* for Dec. 1827, where a number of small worms were discovered in the eye of a man. On examination, they proved to be the *larvæ* of the common fly, (*Musca carnaria,*) which had been deposited in the form of eggs on the eye while the man was asleep. These afterwards hatched out, and the result was a total loss of vision.

tinct view of his tormentor. I believe the horse was quite blind in that eye, for it appeared as if all the humors were confounded together, and that the worm had the whole orb to range in, which, however, was not of a diameter sufficient for the worm to extend its whole length, as far as I could discover. As this is a very uncommon circumstance, and may affect some philosophical doctrines, it is much to be lamented that the horse had not been purchased, and the eye dissected for better examination. That there was a living, self-moving worm within the ball of the horse's eye, free from all deception or mistake, I am most confident. How this worm got there, or if bred in so remarkable a place, where its parents came from, or how they contrived to deposit their semen or convey their egg into the eye of an horse, I leave for others to determine."

The additional particulars communicated by Dr. Morgan, are that the horse was of a sorrel color, nine years old, and belonged to Dr. Dayton, near Elizabethtown, New Jersey. The first circumstance which attracted the owner's attention was, that from being very mild and gentle, the horse suddenly became vicious and unmanageable, and ran away and dashed the chair to pieces. When seen by Dr. Morgan the worm was about four inches in length, and "as thick as a knitting-needle, or piece of common twine." The aqueous humor was of a white, milky appearance, bordering on the color of a cataract, which was supposed to be owing to a breaking down of the vitreous humor, which had thus discolored the aqueous portion. The iris was thought to be destroyed, but this was doubtless a mistake. At this time the animal passed freely from the anterior to the posterior chamber of the eye, and *vice versa*, which the Dr. supposed could not have happened unless the partition between had been broken down. But it so happens that there is no partition between the two except the thin membrane of the *iris*, through which there is an opening, the *pupil*, of sufficient size to permit a free passage. "It may be presumed," says the writer, "that whatever might be the state of vision, that eye must be now blind. The lids are commonly closed, probably owing to pain excited in the eye by so troublesome a guest; but there is no blood-shot appearance on the cornea, though the surrounding parts, namely, the palpebræ, are a little tumid. To get a view of the eye, the keeper commonly strikes the horse on its back with an open hand, at which, as if

frightened, it opens the lid of the left, as well as widens the opening of the right eye, which continues disclosed but a short time; however, this gives an opportunity for inspection for five or six seconds of time together, and the blows must be repeated to keep the eye open when a person wishes to have a longer time for inspection."

The similarity of this case to the one now exhibiting, is too obvious to need remark. In all their essential points there is almost an exact correspondence, viz. the size, color, shape and appearance of the worm; its incessant motion; the cloudiness of the aqueous humor, and the partial blindness of the eye. In the case, however, reported by Mr. Hopkinson, the worm appeared to excite more sensation in the eye, and consequently produced a higher degree of inflammation. This no doubt was occasioned by its passing through the iris, and coming in contact with the expansion of the retina and the delicate *ciliary processes;* whereas in the present case, the animal is confined exclusively to the anterior chamber of the eye, which is comparatively insensible.

Origin.—It is a singular fact that some of the first physiologists and helminthologists of the day, attribute the origin of intestinal and visceral worms to *spontaneous generation.* Such is the opinion of Muller, Bremser, and most of the German physicians. The opinion of Linnæus, that they were terrestrial or aquatic species, taken in with food or drink in the form of ova or germs, is now exploded, for, with the exception perhaps of the *Filaria*, we do not find the same species of worms which infest animal bodies, out of them. Indeed, Cruvelhier lays it down as an axiom, *that worms, like the intestinal and visceral, have never been met with out of the bodies of man and other animals, unless discharged from them;* and the converse of this he holds to be no less true, viz. *that no terrestrial or aquatic worms have ever been met with alive, in the bodies of men and other animals, unless they had been very recently introduced into them.* We might then conclude, with confidence, that worms do not originate from without, but are generated within the body, were it not contended that these animals may have been introduced *ab externo*, but that in consequence of a change of situation and nutriment, their forms and characteristics are altered, as plants and animals are under similar circumstances, and as *neuter bees* are made prolific, on the loss of the queen bee, by

feeding in a particular manner. But if such transitions occur in worms, we should sometimes observe them while undergoing the process, for it would be contrary to all analogy to suppose that the change would be sudden. But we see no such transitions; we never find these animals "half way between what they were and what they are." No zoologist, not even Bremser, who devoted twelve years of his life to the study of Entozoa, ever witnessed any such change; indeed, he states expressly, "that after having diligently examined 15,000 specimens of worms in the Cabinet of Vienna, he never was for one moment at a loss to say which were intestinal worms and which were not." If worms then originate within the body, *how* do they originate?—what are the obstacles in the way of our adopting the theory of *spontaneous generation?* In the first place, if they can be formed by the mere combination of inorganic elements, we may well ask, why they should be furnished with reproductive organs? No such creations or combinations have ever been observed, and therefore the fact of their occurrence is a matter of mere supposition. The only argument on which this hypothesis may be said to rest, is our ignorance of the precise mode of their origin, and derives no support from analogy.

If this theory be true, it is difficult to explain why the law should be confined to the lower classes of animals, and not also extend to the higher. By some fortuitous concourse of atoms, we should expect, occasionally, to see a man, a quadruped, or a bird, spring up from some dunghill, or fermenting vat; but this is a phenomenon which even Ovid never dreamed of.

The production of certain species of vegetables was once as difficult to explain, as it now is to account for the origin of intestinal worms; but late investigations have removed these difficulties, and shown that they are propagated in the usual manner by seed or reproductive granules. Thus it is observed that white clover is ready to spring up on soils which have been rendered alkaline by the strewing of wood-ashes, or the burning of weeds; ground newly turned up by the plough is found to produce plants dissimilar to any in their neighborhood; parasitic *fungi* sprout up upon decaying organized substances, and even in the interior of cheese, &c. Dr. Good remarks that he "has seen a hop-ground completely overrun and desolated by the *Aphis humuli*, or hop green-louse, within twelve hours after a honey-dew (which is a

peculiar haze or mist, loaded with a poisonous miasm) has slowly swept through the plantation, and stimulated the leaves of the hop to the morbid secretion of a saccharine and viscid juice, which while it injures the young shoots by exhaustion, renders them a favorite resort for this insect, and a cherishing nidus for the myriads of little dots that are its eggs. The latter are hatched within forty eight hours after their deposit, and succeeded by hosts of other eggs of the same kind; or, if the blight take place in an early part of the autumn, by hosts of the young insects produced viviparously, for, in different seasons of the year, the Aphis breeds both ways." The inference which Dr. Good deduces from these phenomena, is, that the atmosphere is freighted with myriads of insect eggs that elude our senses, and that such eggs when they meet with a proper bed are hatched in a few hours into a perfect form. In this manner, damp cellars are covered with *Boletuses*, *Agarics*, and other *fungi*, and walls and rocks with *lichens* and *mosses*. In these cases it is now fully ascertained, that the vegetable is propagated by reproductive granules contained in the *frond* of the *Algæ*, the *spores* of the higher *Cryptogamia*, the *pileus*, or cap of the *Fungi*, and the *pollen* of the *anthers* of the *Phanerogamia*.

If we adopt the theory of spontaneous generation, we not only are obliged to adopt the hypothesis of the *Archeus*, to direct its operations, but we shall be unable to account for the extinction of some races of organic beings; we shall be unable to explain the limitation of the characters of different genera and species, to certain defined limits; and we shall equally be at a loss to account for the non-production of new genera and species. Why is it, on this hypothesis, that each species is produced of nearly a certain uniform size, neither larger or smaller? And why is not the whole mass of matter operated upon by this *spiritus mundi*, changed into organized beings?

Because we cannot, in many cases, actually detect the ova or germs, it by no means follows that they do not exist; and because we find a plant or an animal in some unusual habitat, we are not necessarily obliged to suppose that it could only have been brought into existence by spontaneous generation. It has been well observed, that "there are very few, if any, facts taken in support of the doctrine of equivocal generation, but what may as equally, and perhaps as justly, be used to support the contrary

opinion; for it is not the obvious appearance of the organisms, whether vegetable or animal, that is disputed, but the cause of their appearance. A known organism appears in some unusual place from its previously known habitats, or an unknown one is observed in some locality never as yet minutely examined, or at least not made known that it has been examined; the advocates of spontaneous generation immediately say, that our doctrine is the right one is plainly evident, because here an organism has appeared which cannot be accounted for otherwise. Is assertion to take the place of positive facts? and is not this mere assertion? How can we *prove* that there were no germs of that type of organisms in that place where we now observe the organism in question? We find, when we begin to examine it, that it produces germs itself; then by what parity of reasoning can we assert that it has sprung from matter without any previous germ, when we find, in every succeeding instance, a germ is always given for a succeeding organism?" A full consideration of this subject would require an investigation into the nature of the *vital principle* and the *vital powers*, which our limits will not allow; we therefore dismiss the question, with the single remark that it is more in accordance with the dictates of sound philosophy, in all doubtful cases, to acknowledge our ignorance than to attempt to assign a cause to explain such extraordinary phenomena.

Another theory has lately been advanced, which receives the support of some highly respectable names in physiology. It is that worms are produced within the body by some living process or function of the organism, analogous to the secretion of lymph upon a serous surface. An organized portion of matter is thus formed, under the influence of the vital principle of the original animal, which is afterwards thrown off and becomes a separate being, and capable of an independent existence. In answer to this hypothesis it is sufficient to say, that we have no proof whatever of the existence of such formations; that they are contrary to all analogy, and will not explain the identity of characteristics which form the different genera and species. In short, it has no better foundation to rest upon than Bremser's notion that intestinal worms are formed by the presence of semi-assimilated nutritious matter in the digestive tube.

There remains, therefore, but one other theory, and that is the one which attributes the origin of intestinal and visceral worms, in all cases, to ova. Ehrenberg has clearly proved by his careful microscopical observations, that these animals have organs of reproduction clearly developed, and never deficient; indeed, surpassing in development, for the most part, those of other organic systems; thus plainly pointing to a predominant cyclical development, in the same manner as we find in the higher organisms. Ehrenberg has also shown that the fecundity of these animals is most astonishing, each female producing thousands, if not millions of ova at a time. The same diligent and accurate observer states, that if we carefully examine animal bodies, whether of man or other animals, we shall, in nearly all cases, discover worms of some kind, and that we do not meet with more, he thinks is owing to the great difficulties in the way of the development of the ova, among which the resistance of the vital principle is not the least. He therefore believes that the eggs of intestinal worms are taken into the circulation and carried into all parts of the body, but are developed only where the particular conditions requisite for this purpose are favorable. "The smaller diameter of the finest vessels through which they have to pass," he remarks, "does not appear to me to present any important difficulty, because these, as we see in every inflammation, become easily and quickly expanded as soon as they are irritated; and these eggs may, as excretive bodies, like every body which is foreign to our organism, act in an irritative manner, and may be taken up by the embouchures of the absorbents and be propelled along with increased activity through them; that this is the case with mercury, pus and other matters, has been already received as an observed fact. It is even probable that the eggs of the *Entozoa* and their propulsion through the vascular system may be an important morbid matter hitherto overlooked, and which causes a part of the phenomena comprehended under the name scrofula. In bodies which are particularly favorable to the development of worms, there must necessarily be an innumerable quantity of secreted eggs of these parasites, which, if they are not expelled by the intestinal canal or by the *primæ viæ*, must, as foreign bodies, produce disorders. If the absorption takes place entirely or for the most part in the lymphatics, it would occasion their general or sole influence upon that system. Obstructions in the

lymphatics, but especially in their reticular tissue, the glands, which lead to local congestions of lymph, inflammations, and morbid appearances of various kinds, become in this manner very easy of comprehension; and these assuredly deserve the attention of medical science, not as speculations, but as realities. Thousands of eggs of intestinal worms, whose existence in many bodies can not be denied, must perish, as they are rarely developed in such great quantities from the difficulty of their attaining the place and conditions favorable for their development; while only some, very often none, ever actually attain those conditions. This relative proportion of the number of intestinal worms and of their eggs to the organs of the larger animals, is also found to exist. There are very often observed in animal dissections a small number of full-grown worms, filled with an innumerable quantity of eggs, without any young in their proximity; and I was often astonished to find in the considerable number of my dissections of animal bodies, (I have brought from Africa alone intestinal worms of 196 species of animals, all of which I have myself dissected, and of some from 40 to 50 individuals,) only a few alive, although these were completely filled with eggs. Thus from laborious observations this opinion has become more and more firmly fixed in my mind, that it is much more astonishing how the great fecundity of the Entozoa should be so limited by the living organs, than that it should be possible that living worms should inhabit them, and, considering their diffusion, escape observations which are generally superficial."

Such are the views of this very able naturalist on this difficult subject, and I believe they are those which eventually will be generally adopted. In this manner can we only satisfactorily account for the existence of worms in the fœtus of man and other animals, and in the intestines of chickens and the young of other birds, which have just broken the shell; numerous instances of which have been recorded by Rudolphi, Blumenbach and others. I see no great difficulty in the supposition that these ova are absorbed by the lacteals and lymphatics, and carried into the circulation, as they are known to be smaller than the particles of quicksilver, and the coloring matter of madder, &c., which it is well known are constantly taken up and deposited in the bones and other tissues of the body. We believe then that it is in the highest degree probable, if not actually proved, that the minute

ova are thus introduced into the blood, carried to every part, and *there* only hatched, where they meet with a suitable *nidus* or *pabulum*, and other circumstances are favorable to their development.* Thus are they transmitted from parent to offspring, and thus do we account for the fact that each species of animal has its own parasites. In this manner the ovum of the *Filaria* was deposited in the eye of the horse now exhibiting in this city, there hatched into existence, and where it may now be seen, reveling in an element which appears, so far as we can judge, to be highly congenial to its nature and habits.

New York, June 24, 1840.

Postscript. July 22, 1840.—Since writing the above I have seen numerous Filaria in *eels* and *black-fish*, chiefly on each side of the spine; and the fishmen inform me that they have seen them in the eyes of fishes. Mr. A. Halsey also stated at the meeting of the Lyceum, after the above paper was read, that he had often seen Filaria in coleopterous and other insects. I have ascertained that they are extremely tenacious of life, and will not only bear *freezing*, but a temperature little inferior to that of boiling water, without depriving them of life. Professor Owen of London, the celebrated comparative anatomist, estimates the number of ova in one *Ascaris lumbricoides* which he examined, at 64,000,000. (*Lancet*, June.) The fecundity of the Filaria is probably not inferior.

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* "A very curious disease of the eye has in a few instances been observed. The common symptoms of ophthalmia appear, as injection of the conjunctiva, dimness of the cornea, weeping and swelling of the cornea. These are properly attended to, but the inflammation increases; and on very close examination, a *small white worm*, about the size of a hair and an inch in length, is found swimming in the aqueous humor, or that fluid which is immediately behind the cornea. Now it is at once evident that the only way to get rid of or to destroy this worm, is to puncture the cornea and let it out; and this method has been resorted to. In some cases, however, not many days pass before another worm makes its appearance, and the operation is to be performed a second time, and the horse eventually loses that eye. A veterinary surgeon, M. Chaigraud, who seems to have had most experience about this, says that three or four days before the appearance of the worms, *one or two minute bodies, of a reddish white color, are seen at the bottom of the anterior chamber of the eye.* He also says, that the disease appears about June, and is not seen after December. There is no difficulty about these animalcules getting into the eye, for there are undisputed instances of their passing through the smallest capillaries, and being found in almost every tissue."—*Youatt on Cattle*, *p.* 293.